SECTION 02674

DISINFECTION OF WATER WELLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disinfection requirements for new or existing water wells, and permanent equipment and material used in water wells.

B. Dechlorination procedures for chlorinated water discharges.

C. Discharge requirements (point of discharge and chlorine concentration).

1.2 LANL PERFORMED WORK

A. Water quality testing: LANL will perform water quality testing of water samples taken from piping systems for chlorine concentrations and bacteriological quality. LANL will approve use of disinfected wells and well equipment when test results demonstrate compliance with the Maximum Contaminant Levels (MCLs) of the Safe Drinking Water Act as described in Section 1.3.D.

1.3 DESCRIPTION

A. Disinfection Requirements

1. Take precautions to protect the casing and fittings against contamination during construction. Arrange casing delivered for construction so as to minimize the entrance of foreign material.

2. Notify the Construction Inspector prior to any discharges as described in Section 1.3.C.

3. Disinfect well and well equipment as described in Section 3.1.

4. LANL will perform water quality testing of water samples taken from well for chlorine concentrations and bacteriological quality as described in Section 1.3.E.

5. Do not place well in service until notified by the Construction Inspector that the water quality test results are approved by LANL, as described in Section 1.3.D.

B. Dechlorination Requirements

1. Notify the Construction Inspector of any discharges as described in Section 1.3.C.

2. Dechlorinate applicable discharges with neutralizing agent to reduce total chlorine concentration to less than 1 mg/L (1 ppm) prior to release to the environment.

C. Discharge Requirements

1. Chemical Concentration Requirements of Discharge Water

a. Chlorinated waters used for disinfection must be dechlorinated prior to discharge as described in Section 3.3.

b. Hypochlorites and sodium thiosulfate may increase well water alkalinity beyond the pH limits allowed for discharge. Dechlorinated water may require acidification with a dilute acid such as vinegar to ensure that the discharge pH is between pH6 and pH9.

2. Water discharged to the environment must comply with the Water Quality Standards for Discharge of Waters based on general Notice of Intent to Discharge and State of New Mexico Groundwater and Surfacewater Quality Protection Regulations. pH of discharge water must be greater than 6.0 standard units and less than 9.0 standard units, and have a maximum total chlorine concentration of 1 mg/L (1 ppm). Maximum allowable concentration of other analytes are as follows:

Total Aluminum	5.0	mg/L
Total Arsenic	0.2	mg/L
Total Boron	5.0	mg/L
Total Cadmium	0.05	mg/L
Total Chromium (Cr(III) and Cr(VI))	1.0	mg/L
Total Cobalt	1.0	mg/L
Total Copper	0.5	mg/L
Total Lead	0.1	mg/L
Total Mercury	0.012	Fg/L
Total Selenium	0.002	mg/L
Total Vanadium	0.1	mg/L
Total Zinc	25.0	mg/L
Radium-226 + Radium-228	30.0	pCi/L
Tritium	20,000	pCi/L
Gross Alpha	15	pCi/L
Oil and Grease	15	mg/L

No floating solids, and no visible oil, grease, or foam.

a. For water discharge requirements required of the Contractor, refer to Section 01325.

3. Water discharged to a National Pollutant Discharge Elimination System (NPDES) permitted outfall must comply with all parameters of that particular outfall, including chlorine concentration, as described in the National Pollutant Discharge Elimination System Permit No. NM0028355.

a. For discharge of chlorinated/dechlorinated water, notify the Construction Inspector, as described in Section 1.3.D, to arrange for a total chlorine concentration test.

4. Employ Best Management Practices (BMPs) to prevent erosion from discharge of waters.

5. Notify the Construction Inspector immediately in the event of any accidental discharge.

D. Water Quality Testing

1. Notify the Construction Inspector at least 48 hours (2 working days) in advance to arrange for a free or total chlorine concentration test.

2. Notify the Construction Inspector at least 48 hours (2 working days) in advance to arrange for a bacterial quality test.

3. Requirements for demonstration of compliance with the Maximum Contaminant Levels (MCLs) of the Safe Drinking Water Act:

a. Total chlorine concentration of less than 1 mg/L (1 ppm).

b. The absence of any coliform bacteria.

c. Less than 200 noncoliform bacteria per 100 mL sample.

E. Notifications and Records Required of Construction Inspector

1. For discharge requirements of potable water used for flushing and line disinfection, refer to Section 01325.

2. The Construction Inspector will notify the Water Quality and Hydrology group (ESH-18; 665-2014) immediately in the event of any accidental discharge.

3. Water Quality Testing

a. The Construction Inspector will notify the Contract SDWA Compliance Laboratory (667-0105) at least 24 hours (1 working day) in advance to arrange for a total chlorine concentration test.

b. The Construction Inspector will notify the Contract SDWA Compliance Laboratory (667-0105) at least 24 hours (1 working day) in advance to arrange for a bacterial quality test.

c. The Construction Inspector will notify the Contract SDWA Compliance Laboratory (667-0105) at least 24 hours (1 working day) in advance to arrange for monitoring batch treated discharge for pH and chlorine.

PART 2 CHEMICAL PRODUCTS

2.1 MATERIAL SAFETY DATA SHEETS

A. Material Safety Data Sheets for all chemical products, including disinfection and dechlorination products, must be maintained on site by the Contractor.

2.2 ACCEPTABLE DISINFECTANTS

A. Sodium hypochlorite solution (bleach) contains approximately 5 percent to 15 percent available chlorine. Care must be used in control of conditions and length of storage to minimize its deterioration.

B. Calcium hypochlorite (HTH) granules contain approximately 65 percent available chlorine by weight. HTH will not readily dissolve in water with a temperature of less than 41EF (5EC). HTH should be stored in a cool, dry, and dark environment to minimize its deterioration. Direct placement of solid phase HTH into piping is not permitted.

C. Disinfection with chlorine gas or liquid is not permitted.

2.3 ACCEPTABLE NEUTRALIZING AGENTS

A. Use sodium thiosulfate (technical grade, prismatic rice) as the neutralizing agent.

B. Use of sulfur dioxide gas is not permitted.

2.4 PRECAUTIONS

A. Calcium hypochlorite (HTH) is corrosive and is a strong oxidizer. Reducing agents (*e.g.* sodium thiosulfate), concentrated acids, and organic compounds (*e.g.* antifreeze, gasoline), can oxidize, burn or explode if they come into contact with HTH.

B. Do not use calcium hypochlorite (HTH) on solvent-welded plastic pipe or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with HTH.

C. Any acidifying agent must be added to the dechlorinated discharge after dilution and mixing of thiosulfate with the chlorinated water to prevent the release of sulfur dioxide gas.

PART 3 EXECUTION

3.1 DISINFECTION OF WATER WELLS

A. Disinfect all permanent equipment and material to be installed in the well just prior to its installation. Spray all exposed areas of the items with a solution having a total chlorine concentration of not less than 200 mg/L.

B. After permanent equipment is installed, disinfect the well by the following:

1. Treat the entire volume of water in the well casing, and gauge lines, to a free chlorine concentration of not less than 50 mg/L (50 ppm). Use amounts of calcium hypochlorite (HTH) or sodium hypochlorite per 100 linear feet of water in the entire well as follows:

Well-Casing Nom. Pipe Size *In.*	Calcium Hypochlorite (HTH) Required per 100 ft of water *(65-Percent available chlorine)*	Sodium Hypochlorite Required per 100 ft of water *(12 trade percent)*
4	1 oz	4 fl oz
6	2 oz	8 fl oz
8	3 oz	14 fl oz
10	4 oz	1.4 pt
12	6 oz	2.0 pt
16	10 oz	3.5 pt
20	1 lb 1 oz	0.7 gal
24	1 lb 8 oz	1.0 gal
30	2 lb 6 oz	1.5 gal
36	3 lb 6 oz	2.2 gal
48	6 lb 1 oz	3.9 gal
60	9 lb 7 oz	6.1 gal

a. Disinfection by calcium hypochlorite (HTH): Distribute the calcium hypochlorite evenly throughout the water column with a chlorine basket. Run the basket to the bottom of the well and retrieve it. Repeat this process until all of the calcium hypochlorite is dissolved.

b. Disinfection by use of sodium hypochlorite solution: Ensure the sodium hypochlorite solution reaches all parts of the well.

2. Following application of the chlorine solution, surge the well at least three times to

improve the mixing and induce contact of chlorinated water with the adjacent aquifer. Allow the chlorinated water will remain in the casing for at least 12 hours, but not more than 24 hours.

3.2 PUMPING OF WELL FOLLOWING DISINFECTION

A. Notify the Construction Inspector prior to discharge of water from the well as described in Section 1.3.C.

B. Contact the Construction Inspector to arrange for final total chlorine concentration and bacteriological quality tests as described in Section 1.3.D.

C. All discharges from pumping must conform with Section 1.3.C. Method of dechlorination of discharges is described in Section 3.3.

D. After the chlorinated water has remained in the casing for at least 12 hours, but not more than 24 hours, pump the well to remove the chlorinated water.

E. The Contract SDWA Compliance Laboratory will periodically test discharge water for determination of total chlorine concentration.

F. When total chlorine concentration of discharge is zero mg/L, continue pumping the well for at least 15 minutes.

G. Section 3.2.F, the Contract SDWA Compliance Laboratory will collect at least duplicate samples, to be taken not less than 30 minutes apart for and bacteriological quality tests.

H. After the final total chlorine concentration and bacteriological quality tests have been completed, the Construction Inspector will furnish the disinfection report to the Contractor. If the water quality tests do not show compliance with the Maximum Contaminant Levels (MCLs) of the Safe Drinking Water Act as described in Section 1.3.D, re-disinfect the well until all test results demonstrate compliance.

3.3 DECHLORINATION OF DISCHARGES

A. Sodium thiosulfate crystals may be applied manually or a liquid solution of sodium thiosulfate may be directly injected into the chlorinated water discharge pipe using a metering pump or venturi ejector.

B. Provide a mixing tank to allow dechlorination of water prior to discharge.

C. The approximate dosage rate of sodium thiosulfate may be calculated from the following table:

Free Chlorine Residual Concentration	Sodium Thiosulfate ($Na_2S_20_2•5H_20$)
10 mg/L	1.2 lb/10,000 gal
50 mg/L	6.0 lb/10,000 gal
500 mg/L	60.0 lb/10,000 gal

D. Do not overdose sodium thiosulfate beyond the minimum required to neutralize the chlorine actually present in the discharge.

END OF SECTION